

A COMPARATIVE STUDY OF THE PHYSICAL AND CHEMICAL CHARACTERISTICS OF GUINEA FOWL AND DOMESTIC CHICKEN EGGS.

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ABSTRACT

Some physical and chemical parameters of eggs from the domestic chicken and guinea fowl, reared under identical conditions were studied in order to determine the difference in their composition. The eggs analyzed were collected from domestic chickens (Warren Strain) and domesticated guinea fowls (Grey breasted pearl strains) which were about 40 weeks old and maintained on the same layer diet with groundnut cake as the protein source. The guinea fowl egg had significantly higher shell thickness than chicken egg shell, but the latter showed greater variation in shell thickness between eggs. Correlations between a number of physical and chemical parameters were small in both chicken and guinea fowl eggs. Although the chicken egg had significantly higher albumen and yolk contents compared to the guinea fowl egg, the protein, fat and amino acid composition of the two types of eggs, expressed as gram per 100g edible portion, were independent of breed.

Key words: Eggs, characteristics, guinea fowl, chicken.

INTRODUCTION

Eggs are a rich source of high quality protein and provide a unique source of nutrients for human. In Nigeria, guinea fowl eggs rank second to domestic fowl eggs in the supply of table eggs (Ayeni, 1983). Most of these guinea fowl eggs are produced by birds in the wild state. Under this condition, the birds fend for themselves and they hardly get sufficient feed. It is usually believed among the local people that guinea eggs are more nutritious than those of the domestic fowl.

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According to Ayeni (1983), the preference for guinea fowl eggs in the rainy season when they are produced depresses the sale of domestic fowl eggs.

Extensive studies on the nutrient composition of eggs from domestic chicken have been carried out and several reviews on these have been made (Romanoff and Romanoff, 1947; Everson and Souders, 1957; Cook and Briggs, 1973; Stadelman and Cotterill, 1973). In contrast, information on the nutrient composition of guinea fowl eggs is rather scanty. With the realization of the role of guinea fowls in the nutrition of Nigerians, there is now increasing awareness of the need to domesticate and improve them.

We report here some of the physical and chemical composition of eggs produced by domesticated guinea fowls maintained on conventional poultry ration. The results are compared with those from commercial Warren chicken of the same age and maintained under identical conditions.

MATERIALS AND METHODS

Eggs from two strains of guinea fowls (Grey breasted and Pearl) and those from the commercial fowl of the Warren strain were used in this study. All birds from which the eggs were collected were about 40 weeks old and were maintained on the same chicken layer diet with groundnut cake as the protein source. The diet contained 16% protein and was supplemented with lysine (0.2%) and methionine (0.2%). Table 1 shows the composition of the diet fed to the birds.

Thirty eggs were randomly collected from the two strains of guinea fowls and 30 from the Warren chickens. Eggs when collected were stored for not longer than 24 hours before being weighed and hard-cooked. Shells were removed, the yolks and whites separated and sliced. Each of the components were weighed, and oven-dried at 80°C to constant weight. The

egg shells were boiled in 5% sodium hydroxide solution for 12-15 minutes to remove proteinaceous membrane (Christensen *et al.*, 1982). The shell was then rinsed in water, oven-dried and thickness measured using a thickness gauge (Ames, Waltham, Massachusetts). The three components (shell, yolk and whites) were then ground separately and stored in air-tight screw capped bottles at -5°C before chemical analyses were done.

TABLE 1. PERCENTAGE COMPOSITION OF DIET FED TO DOMESTIC CHICKENS AND GUINEA FOWL

Ingredients	%
Maize	46.00
G'nut Cake	20.00
Wheat bran	25.00
Bone meal	3.00
Calcium Carbonate	5.00
Common salt	0.25
Vit/Mineral Premix ¹	0.25
Lysine	0.30
Methionine	0.20
Calculated Analysis	
Protein %	16.00
Calcium %	3.06
Phosphorus %	0.66
Lysine %	0.90
Methionine %	0.60
M E, KCal/kg	26.50

¹ zoodry UM 301 laying Hens contain in 0.15%: Vitamin A, 6670,000 I.U.; Vitamin D₃, 1,340, I.U.; Vitamin E, 6670,000; Vitamin K 1,340mg; vitamin B₂ 3,000mg; Vitamin B₆, 2,000mg; Nicotinic acid 16670mg; Vitamin B₁₂, 13,340mg; Calcium d-pantothenate 5,34mg; Cholin Chloride 66,670mg; Iron 26,670mg Manganese 33,340mg; Zinc 670mg copper 1600mg; Iodine 934mg; Cobalt 134mg; Selenium 34mg.

Protein (N x 6.25) was determined by the micro-Kjeldahl method while fat was determined as ether extract by the standard AOAC

method (AOAC, 1975). Bulk samples of albumin or yolk were analysed for amino acid content by hydrolysing with 6N HCl under reflux for 24h. The acid was evaporated *in vacuo* in a rotary evaporator and the residue dissolved in a pH 2.2 Citrate-phosphate buffer and made to known volume. Aliquots of the hydrolysate were then run on a Technicon TSM-1 amino acid analyzer equipped with an integrator and printer.

Data collected for moisture percent of albumen, albumen weight, albumen protein, moisture percent of yolk, yolk weight, yolk protein and yolk fat, as well as shell thickness are summarised in Table 2. Analysis of variance and regression were carried out by the methods of Snedecor and Cochran (1956).

RESULTS AND DISCUSSION

Some physical and chemical parameters of the domestic chicken and guinea fowl eggs are given in Table 2. The two types of poultry showed similar levels of protein and fat in both albumen and yolk. Differences between the two eggs were only observed for such parameters as shell thickness, albumen and yolk weights and these were highly significant ($P < 0.001$). This is to be expected for albumen and yolk weights since chicken egg is heavier than guinea fowl egg and so should contain more albumen and yolk. Data on egg shell (Table 2) showed that the weight of shells of chicken and guinea fowl eggs were equal. Thus, although the chicken egg is generally larger than that of the guinea fowl, the loss in surface area in the latter's shell is compensated for by the increase in shell thickness. This is confirmed by the fact that guinea fowl egg shell is significantly thicker ($P < 0.001$) than that of chicken. The mean weights of the chicken and guinea fowl egg shells are 5.91g and 5.83g respectively. The coefficient of variation for chicken egg shell weight is 0.859g and that of the guinea fowl is 0.870. The variation in the two types of poultry is therefore about the same. The mean thickness of the shells of chicken is 0.340mm while that of the guinea fowl is 0.475mm. The coefficient of variation of the thickness of chicken and guinea fowl eggs are 1.859g and 1.331 respectively. This shows that there is more variation within the chicken egg shell thickness than with the guinea fowl's. This variation may be connected with the variation in the size of eggs laid by chickens compared with the lower variation within the guinea fowl eggs.

TABLE 2. SOME PHYSICAL AND CHEMICAL PARAMETERS OF THE DOMESTIC CHICKEN AND GUINEA FOWL EGGS.

	Domestic Chicken	Guinea Fowl
Shell weight (g)	5.91 ± 0.62a ¹	5.83 ± 0.60a ²
Shell thickness (mm)	0.34 ± 0.034a	0.48 ± 0.193
Albumen moisture %	85.22 ± 2.34a	84.95 ± 1.52a
Albumen wt.(g/100g wet wt)	35.06 ± 2.53a	17.97 ± 1.92b
Albumen prot. " "	9.97 ± 0.59a	9.32 ± 1.92a
Albumen fat " "	0.00a	0.00a
Yolk moisture %	47.21 ± 2.39a	47.81 ± 1.95a
Yolk weight(g/100g wet wt.)	16.03 ± 0.97a	11.28 ± 1.01b
Yolk protein " "	15.53 ± 0.58a	15.29 ± 0.37a
Yolk fat " "	25.39 ± 2.81a	25.26 ± 2.20a

¹Mean ± standard deviation. Different letters attached to values in the same row indicate highly significant (P < 0.01) differences

The correlations between the different parameters of albumen and yolk were very small for both chicken and guinea fowl (Table 3). Those of the chicken varied between 0.002 for yolk fat and the percent moisture in yolk and 0.419 for yolk protein and yolk weight. In the case of the guinea fowl, the correlations varied from -0.058 for yolk fat and yolk weight and 0.445 for yolk weight and albumen weight.

domestic chicken (Cotterill *et al.*, 1977). This is not surprising especially as Naber (1979) has shown that the nutrient composition of shell egg has not changed greatly in response to modern industrial practices. However, higher levels of lysine and histidine were observed here, particularly for yolk compared with previous reported values (Cotterill *et al.*, 1977).

In Nigeria, eggs are not graded and sold accord-

TABLE 3. CORRELATIONS BETWEEN CHICKEN EGG TRAITS(BELOW DIAGONAL) AND GUINEA FOWL EGG TRAITS(ABOVE DIAGONAL)

Chicken egg Traits	1	2	3	4	5	6	7	G. Fowl Egg
Album. Moisture		0.16338	0.1888	0.0416	0.0294	-0.5123	-0.1608	1. Alb. Moist.
Album. Weight	0.05977		-0.0352	0.2861	0.4445	-0.3574	-0.1688	2. Alb. Wt.
Album Protein	0.04584	0.04723		0.3377	0.3299	0.1335	0.0587	3. Alb. Prot.
Yolk Moistur	-0.06680	-0.31527	-0.0927		0.3021	0.2239	0.2227	4. Yolk Moist
Yolk Weight	-0.15214	-0.05392	-0.1892	0.1634		0.0082	-0.0578	5. Yolk Wt.
Yolk Protein	0.19369	0.09109	-0.0717	0.2469	0.4192		0.1766	6. Yolk Prot
Yolk Fat	0.01056	-0.2627	-0.2439	-0.0016	-0.1753	-0.0767		7. Yolk Fat

The amino acid composition of albumen, yolk and whole egg (albumen + yolk) of Warren chicken and the guinea fowl are very similar as shown in Tables 4 and 5. Furthermore, the levels of amino acids reported here both for chicken and guinea fowl eggs generally showed good agreement with those already published for

ing to weight or size. Currently, the difference in price between the guinea fowl egg and chicken egg is not much. Since chicken egg is bigger than guinea fowl egg, it means that it is more economical in terms of protein/ amino acids to buy chicken egg than guinea fowl egg. The assumption by consumers in Nigeria that guinea

TABLE 4. AMINO ACID COMPOSITION OF CHICKEN AND GUINEA FOWL EGGS (g/100g Edible Portion)

CHICKEN	LYS	HIS	ARG	ASP	THR	SER	GLU	PRO	GLY	ALA	CYS	VAL	MET	ILE	LEU	TYR	PHE
Albumin	0.75	0.35	0.54	1.00	0.51	0.68	1.31	0.38	0.37	0.64	0.22	0.75	0.39	0.55	0.83	0.44	0.65
Yolk	1.60	0.58	1.17	1.44	0.84	1.24	2.01	0.63	0.50	0.90	0.46	1.02	0.41	0.91	1.39	0.77	0.74
Albumin + Yolk	0.98	0.39	0.66	1.13	0.57	0.81	1.49	0.42	0.43	0.73	0.32	0.79	0.39	0.57	0.95	0.50	0.63
CHICKEN																	
Albumin	0.61	0.28	0.38	0.76	0.56	0.61	1.18	0.40	0.34	0.53	0.23	0.72	0.30	0.53	0.82	0.50	0.57
Yolk	1.54	0.62	1.18	1.36	0.84	1.24	1.98	0.65	0.52	0.89	0.51	0.94	0.51	0.83	1.40	0.73	0.72
Albumin + Yolk	1.03	0.39	0.70	1.06	0.66	0.79	1.42	0.45	0.39	0.58	0.36	0.77	0.34	0.60	0.99	0.57	0.61

TABLE 5. AMINO ACID COMPOSITION (g/100g Protein) OF CHICKEN AND GUINEA FOWL EGGS

GUINEA FOWL	LYS	HIS	ARG	ASP	THR	SER	GLU	PRO	GLY	ALA	CYS	VAL	MET	ILE	LEU	TYR	PHE
Albumin	7.83	3.73	5.62	10.35	5.35	7.05	3.58	3.90	3.85	6.65	2.25	7.77	4.07	5.71	8.67	4.54	6.76
Yolk	10.09	3.64	7.40	9.09	5.30	7.85	12.68	3.96	3.17	5.68	2.89	6.43	2.62	5.75	8.77	4.87	4.70
Albumin + Yolk	9.12	3.64	6.16	10.46	5.33	7.51	13.79	3.87	4.01	6.81	3.01	7.34	3.66	5.33	8.82	4.67	5.82
GUINEA FOWL																	
Albumin	6.52	3.03	4.10	8.23	5.98	6.52	12.71	4.29	3.71	5.69	2.49	7.80	3.25	5.70	8.88	5.42	6.12
Yolk	1.02	4.41	7.82	9.03	5.56	8.25	13.12	4.30	3.47	5.93	3.35	6.26	3.40	5.51	9.28	4.84	4.76
Albumin + Yolk	8.50	3.25	5.82	8.78	5.43	6.55	11.77	3.68	3.22	4.78	2.95	6.38	2.85	4.92	8.17	4.69	5.01

fowl eggs are nutritionally superior to those of domestic chicken is certainly unjustified.

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